

XXII. NOTES ON STOMATOPODA.

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Since the memoir on Indo-pacific Stomatopoda was published in 1913¹ a considerable number of specimens have been added to the collection of the Zoological Survey of India. The majority of these belong to species already known to be abundant on the Indian coasts and, as the records add nothing to our knowledge of their geographical range, we have not thought it necessary to mention them. There remain, however, a number of other specimens interesting from the point of view of their structural peculiarities, rarity, or distribution, together with examples of two species which have not hitherto been recognised. We have included a note on certain Californian specimens of *Gonodactylus*, which have kindly been lent to us for examination by Prof. Ch. Gravier of the Paris Museum. These specimens prove to belong to *G. oerstedii*, hitherto known only from the Atlantic, thus adding greatly to our knowledge of the geographical range of the species.

Calman² has recently drawn attention to the importance of the number of epipodites on the thoracic limbs as a specific criterion in the genus *Squilla* and has given a key to certain Atlantic species in which the primary divisions are based on this hitherto unnoticed character. We find that the epipodites vary in the Indo-pacific species also and we have thought it advisable to examine all the forms represented in the collection and note the number present in each. It is only in the genus *Squilla* that any variation in the number of epipodites is to be found; in all species of *Pseudosquilla*, *Hemisquilla*, *Lysiosquilla*, *Odontodactylus* and *Gonodactylus* that we have examined epipodites occur on all the first five thoracic limbs.³

Epipodites are to be found on the first five thoracic limbs in the following species of *Squilla* :—

¹ Kemp, *Mem. Ind. Mus.* IV (1913).

² Calman, *Brit. Antarctic Exped.* 1910, *Zool.* III, p. 141 (1917).

³ The species examined are *Pseudosquilla ciliata* (Fabr.), *P. cerisii* (Roux), *P. oculata* (Brullé), *P. ornata* Miers, *P. pilaensis* de Man, *Hemisquilla styliifera* (Milne-Edwards), *Lysiosquilla acanthocarpus* Miers, *L. cusebia* (Risso), *L. insignis* Kemp, *L. maculata* (Fabr.) and var. *sulcirostris* Kemp, *L. multifasciata* Wood-Mason, *L. spinosa* (Wood-Mason), *L. vicina* Nobili, *Odontodactylus brevirostris* (Miers), *O. cultrifer* White, *O. japonicus* (de Haan), *O. scyllarus* (Linn.), *O. southwelli* Kemp, *Gonodactylus acanthurus* Tattersall, *G. brevisquamatus* Paulson, *G. chiragra* (Fabr.) and var. *platysoma* Wood-Mason, *G. demani* Henderson, and var. *spinus* Bigelow, *G. excavatus* Miers, *G. furcicaudatus* (Miers), *G. glaber* (Lenz), *G. glabrous* Brooks, *G. glyptocercus* Wood-Mason, *G. graphurus* Miers, *G. herdmanni* Tattersall, *G. nefandus* Kemp, *G. oerstedii* Hansen, *G. proximus* Kemp, *G. pulchellus* Miers and *G. spinosissimus* Pfeffer.

<i>S. annandalei</i> , Kemp.	† <i>S. laevis</i> , Hess.
<i>S. biformis</i> , Bigelow.	<i>S. mantis</i> , Latreille.
<i>S. brazilicnsis</i> , Calman.	<i>S. panamensis</i> , Bigelow.
<i>S. empusa</i> , Say.	<i>S. raphidea</i> , Fabr.
	<i>S. rugosa</i> , Bigelow.

On the first four thoracic limbs in the following species:—

<i>S. africana</i> , Calman.	† <i>S. leptosquilla</i> , Brooks.
† <i>S. armata</i> , Milne-Edwards.	† <i>S. lirata</i> , sp. nov.
<i>S. boops</i> , Kemp.	<i>S. massavensis</i> , Kossmann.
† <i>S. costata</i> , de Haan.	<i>S. microphthalmalma</i> , Milne-Edwards.
<i>S. decorata</i> (Wood-Mason).	<i>S. mikado</i> , sp. nov.
† <i>S. desmaresti</i> , Risso.	<i>S. multicarinata</i> , White.
<i>S. fasciata</i> , de Haan.	<i>S. nepa</i> , Latreille.
<i>S. foveolata</i> , Wood-Mason.	<i>S. oratoria</i> , de Haan.
<i>S. gilcsi</i> , Kemp.	„ var. <i>perpensa</i> , Kemp.
<i>S. gonypetes</i> , Kemp.	† <i>S. polita</i> , Bigelow.
† <i>S. hieroglyphica</i> , Kemp.	<i>S. prasino-lineata</i> , Dana.
<i>S. holoschista</i> , Kemp.	<i>S. quinquentata</i> , Brooks.
<i>S. interrupta</i> , Kemp.	<i>S. stridulans</i> , Wood-Mason.
<i>S. investigatoris</i> , Lloyd.	† <i>S. tenuispinis</i> , Wood-Mason.
<i>S. lata</i> , Brooks.	<i>S. wood-masoni</i> , Kemp.
<i>S. latreillei</i> (Eyd. and Soul.).	

On the first three thoracic limbs in:—

S. dubia, Milne-Edwards.

And on the first two thoracic limbs only in:—

† <i>S. gibba</i> , Nobili.	† <i>S. scorpio</i> , Latreille.
<i>S. supplex</i> , Wood-Mason.	† „ var. <i>immaculata</i> , Kemp.

In the majority of Indo-pacific species epipods are found on the first four thoracic limbs, but there are certain notable exceptions. In *Squilla raphidea* and the closely allied *S. annandalei* they are present on all five limbs and this also occurs in the Australian *S. lacvis*. *S. raphidea* and its ally on other structural characters form a well-defined group in the genus, but *S. lacvis* is not related and appears to be rather an isolated form, allied perhaps to *S. hieroglyphica*. Apart from the possession of the full series of epipods none of these species possess characters which can be regarded as primitive.

We have not found any Indo-pacific species in which epipods are found on the first three thoracic limbs only. Of those which possess them only on the first two thoracic limbs, *S. gibba* seems without doubt to be allied to the forms with reduced eyes (the *Chloridella* section), *S. supplex* is a species of uncertain affinities, while *S. scorpio* perhaps finds its nearest allies in *S. lata*, *S. gilcsi* and *S. armata*. Classified on any other character than that of the

† In this species the mandibular palp is absent.

number of epipodites, these three species take up widely separate positions in the genus.

We are thus led to conclude that a reduction in the number of epipods has taken place in the genus *Squilla* on several different occasions and that the character, though possessing a definite specific value, cannot be used as a guide to the affinities of the different forms. In this it resembles the mandibular palp, which appears and disappears throughout the genus, apparently without any regard to the affinities of the species concerned. In the list given above the species in which the palp is suppressed are indicated by a dagger (†).

Squilla decorata (Wood-Mason).

1913. *Squilla decorata*, Kemp, *Mem. Ind. Mus.* IV, p. 27, pl. i, figs. 13-16.

C 301/1. Jack and Una Is., Mergui Archipelago. 'Investigator.' 1 ♀, 65 mm. go.

Squilla microphthalmalma, Milne-Edwards.

1913. *Squilla microphthalmalma*, Kemp, *loc. cit.*, p. 31, pl. i, figs. 17-20.

Two additional examples of this species have recently been obtained, but the identification of one of them is open to doubt. This specimen, collected by the 'Investigator' in the Mergui Archipelago, differs from the others in the following particulars:—

(i) The rostrum is much narrower and is about one and a half times as long as wide.

(ii) The cornea is decidedly more expanded, its breadth being contained about two and a quarter times in the total length of the eye.

(iii) The eye reaches well beyond the end of the basal antennular segment and fully to the middle of the ultimate segment of the antennal peduncle. In typical *S. microphthalmalma* the eye does not nearly reach the end of the basal antennular segment and barely reaches the base of the ultimate segment of the antennal peduncle, much as in Brooks' figure of *S. chlorida*.¹

(iv) The lateral process of the fifth thoracic somite is short, stout and directed strongly forwards, whereas in typical *S. microphthalmalma* it is directed straight outwards.

(v) The raptorial dactylus bears five teeth (the terminal one included), all of which are well developed and evenly spaced. The proximal tooth is not greatly reduced and does not lie close against the next of the series as in those specimens of *S. microphthalmalma* which possess the same number of teeth.

(vi) There are clear indications of a pair of submedian carinae on the fifth abdominal somite.

The specimen is a male, with the carinae of the marginal teeth of the telson much swollen. It differs from Brooks' account

¹ Brooks, 'Challenger' Rep., *Stomatop.*, pl. ii, figs. 1, 3 (1886).

of *S. chlorida* (i) in the form of the rostrum, (ii) in the length of the eye compared with that of the antennular and antennal peduncles, and (iii) in the direction of the lateral process of the fifth thoracic somite. It perhaps represents a species hitherto unknown, but the resemblances to *S. microphthalma* are so great that we hesitate to describe it as new.

C 303/1. Off Pondi, Madras Presidency, 6 fms.	J. Hornell.	1 ♀, 20 mm.
C 302/1. 4 miles N.N.E. of Kabusa Is., Mergui Archipelago, 33 fms.	'Investigator'	1 ♂, 40 mm.

It should be noted that, apart from a doubtful record from N. Australia (Miers), *S. microphthalma* has hitherto been found only at Zanzibar (Jurich) and from Karachi, Bombay, and the Madras Coast (Kemp). The specimen referred to above is the first that has been obtained on the eastern side of the Bay of Bengal.

Squilla fasciata, de Haan.

1913. *Squilla fasciata*, Kemp, *loc. cit.*, p. 34, pl. i, figs. 21-23.

Seven additional specimens, presented by Dr. T. Kawamura, were brought from Japan by Dr. Annandale. Under the name of *S. fallax*, Bouvier¹ has recently described a closely related species from Mauritius, which, apart from the number of teeth on the raptorial dactylus and other characters, differs from *S. fasciata* in the complete suppression of the mandibular palp. We have re-examined the Indian specimens in comparison with those brought back by Dr. Annandale and have no doubt that all belong to de Haan's *S. fasciata*.

C 298'1. Fomo, Bingo prov., Japan.	T. Kawamura.	3 ♂, 4 ♀, 60-77 mm.
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Squilla scorpio, Latreille.

1913. *Squilla scorpio*, Kemp, *loc. cit.*, p. 42, pl. ii, fig. 30.

1918. *Squilla scorpio*, Sunier, *Contrib. Faune Indes Neerland.* IV, p. 4.

1918. *Squilla scorpio*, Kemp, *Mem. Asiat. Soc. Bengal* VI, p. 297.

Sunier has examined a number of specimens from the Aru Is., Makassar and Batavia without finding any examples of the variety *immaculata*. The variety was, however, found—for the first time in company with typical examples—by Dr. Annandale in the Talé Sap in Peninsular Siam (*v. Kemp, loc. cit.*, 1918). We have seen additional specimens of the typical form from Singapore, collected by Capt. Hutcheson.

Squilla gonypetes, Kemp.

1913. *Squilla gonypetes*, Kemp, *loc. cit.*, p. 54, pl. iv, figs. 42-44.

1918. *Squilla gonypetes*, Sunier, *Contrib. Faune Indes Neerland.* IV, p. 5.

¹ Bouvier, *Bull. sci. France Belgique* XLVIII, p. 308, text-figs. 39-42 (1915).

Sunier is inclined to think that *S. gonyptes* is merely based on young individuals of *S. quinquedentata*, but we are unable to agree with this view. Apart from other characters the corneal and peduncular axes of the eye are more oblique in *S. gonyptes* than in the related species, and it appears to be a general rule that in those forms which possess oblique eyes, the cornea is more transversely placed in the young than in the adult.

The question cannot, however, be settled definitely with the material at present in existence. As Sunier has pointed out, the known specimens of *S. quinquedentata* all exceed 100 mm. in length, whereas the largest example of *S. gonyptes* is only 55 mm. in length.

C 320, 1. Off Kabusa Is., Mergui Archipelago. 'Investigator.' 1♂, 2♀, 40-47 mm.

Sunier has examined specimens from the Java Sea.

Squilla holoschista, Kemp.

1913. *Squilla holoschista*, Kemp, *loc. cit.*, p. 61, pl. iv, figs. 50-53.

1918. *Squilla holoschista*, Sunier, *Contrib. Faune Indes Néerland.* IV, p. 8.

Sunier has recorded this species from Anjer in the Sunda Straits, thus greatly extending our knowledge of its geographical range. The only additional specimens we have seen are from the western side of the Bay of Bengal.

Squilla mikado, sp. nov.

1913. *Squilla stridulans*, Kemp, *loc. cit.*, IV, p. 78 (in part).

In 1913 one of us doubtfully attributed to Wood-Mason's *S. stridulans* a single specimen of *Squilla* found at Misaki in Japan. A second individual which Dr. Annandale obtained in 1915 from the Misaki laboratory proves that the Japanese form, though nearly related to that found in the Bay of Bengal, must be regarded as distinct.

The principal characters in which the two species differ are the following :—

S. stridulans, Wood-Mason.

Undivided portion of mid-dorsal carina of carapace, anterior to dorsal pit, less than one-third as long as bifurcated portion (text-fig. 1a).

Rostrum with an obscure mid-dorsal tubercle (text-fig. 1a).

Cornea much dilated and set very obliquely on eyestalk (text-fig. 1b).

Lateral processes of sixth and seventh thoracic somites shorter and broader (text-fig. 1c).

Surface of abdominal somites finely rugose.

S. mikado, sp. nov.

Undivided portion of mid-dorsal carina of carapace, anterior to dorsal pit about half as long as bifurcated portion (text-fig. 2a).

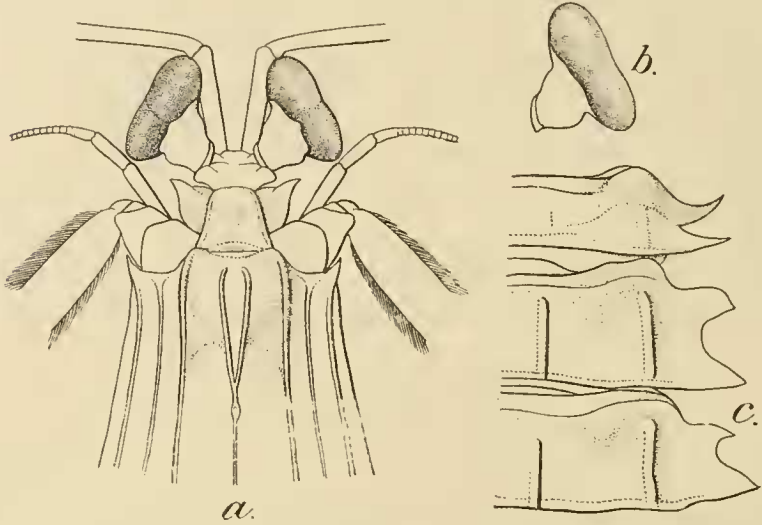
Rostrum with a well defined median carina (text-fig. 2a).

Cornea less dilated and set much less obliquely on eyestalk (text-fig. 2b).

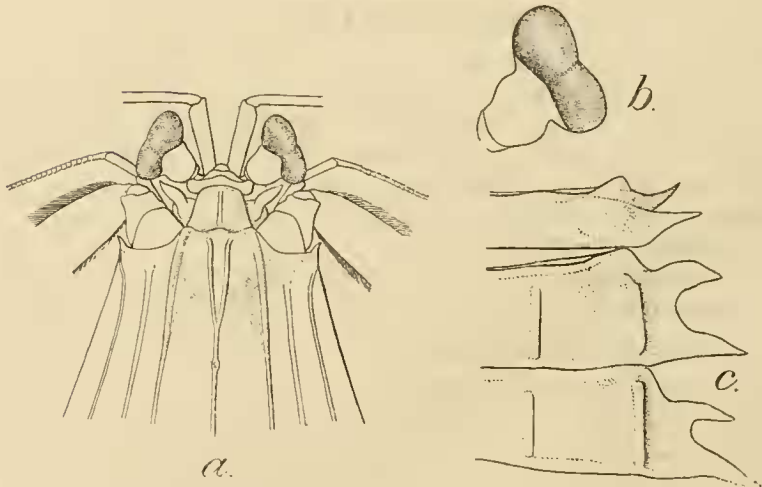
Lateral processes of sixth and seventh thoracic somites longer and more slender (text-fig. 2c).

Surface of abdominal somites coarsely rugose.

S. mikado appears to be a larger species than *S. stridulans*. The two specimens examined are 122 and 144 mm. in length, whereas *S. stridulans* is not known to exceed 100 mm.



Text-fig. 1.—*Squilla stridulans*, Wood-Mason.
 a. Anterior part of carapace, rostrum, etc. b. Eye.
 c. Lateral parts of 5th, 6th and 7th thoracic somites.



Text-fig. 2.—*Squilla mikado*, sp. nov.
 a. Anterior part of carapace, rostrum, etc. b. Eye.
 c. Lateral parts of 5th, 6th, and 7th thoracic somites.

Both the specimens of *S. mikado* show traces of the large dark mid-dorsal patches on the second and fifth abdominal somites

which are found in *S. stridulans*, but they entirely lack the black pigmentation on the posterior margins of the abdominal and exposed thoracic somites which is characteristic of the latter species.

In *S. mikado*, as in *S. stridulans*, the two lobes found in many species of *Squilla* on either side of the fifth thoracic somite are replaced by two sharp spines and the lateral carinae of the first five abdominal somites are bicarinate. These two characters alone are sufficient to distinguish them from all other species of the genus.

7685 10. Misaki, Japan. A. Owston. 1 ♂, 144 mm., TYPE.
C. 30471. Misaki, Japan. N. Annandale (Kuma Aoki coll.). 1 ♂, 122 mm.

Dr. Annandale informs us that the specimen he brought back was probably obtained in deep water.

? *Squilla costata*, de Haan,

1913. *Squilla costata*, Kemp, *loc. cit.*, p. 84, pl. vi, figs. 70-72.

In 1913 comparison was drawn between a specimen of this species from Japan and one obtained on the Burmese coast by Messrs. Simpson and Rudmose Brown and kindly lent by Mr. A. Patience. An additional specimen has since been found on the Burmese Coast by the 'Investigator,' but it is unfortunately in poor condition, having lost both raptorial claws.

We are unable to compare this individual with that previously recorded from Burma, as the latter has been returned to Mr. Patience, but it differs from the Japanese example in all the characters pointed out in 1913, except that (i) the submedian carinae of the last abdominal somite are tricarinate, the three keels meeting posteriorly, and that (ii) of the carinae which terminate in the submedian teeth of the telson edge only that on the right hand side is bifurcate. On close comparison with the Japanese specimen a number of minor distinctions in sculpture are to be found.

We think it probable that the Burmese form is distinct from that found in Japan, but we are unable to draw up a specific definition from a single imperfect specimen that shows signs of immaturity.

C 332 t. 4 miles N.N.E. of Kabusa Is., 'Investigator.' 1 ♀, 35 mm.
Mergui Archipelago.

Squilla lirata, sp. nov.

This species is closely allied to and easily confounded with White's *S. multicarinata* but is distinguished by a number of well-marked characters.

The carinae of the carapace (text-fig. 3) are less numerous than in the allied form and are frequently interrupted and broken up into series of short carinulae or tubercles. In the anterior

part of the carapace between the gastric grooves the carinae are for the most part not continuous as in *S. multicarinata*. Behind the cervical groove there are in the latter species from 26 to 30 well-defined longitudinal carinae, but in *S. lirata* less than half this number can be counted and most of these are irregular and broken up into small tubercles. The median carina in *S. multicarinata* is bifurcated for the whole of the distance in front of the mid-dorsal pit. In one of our specimens of *S. lirata* the arrangement



Text-fig. 3.—*Squilla lirata*, sp. nov.
Carapace and first three exposed thoracic somites.

is similar, but the carina is interrupted at the point where it divides. In the other specimen (text-fig 3) the carina is bifurcated for little more than half the distance between the mid-dorsal pit and the anterior margin.

The rostrum is less quadrate than in the allied species and is more rounded anteriorly. On either side of the median carina only a tubercle or short carinula can be seen. The cornea of the eye is less expanded.

The mandibular palp, which in *S. multicarinata* is composed of three segments, is entirely absent.

The oblique carina on the outer side of the merus of the raptorial claw in *S. multicarinata* is represented in *S. lirata* merely by a slight swelling. The dactylus has six teeth (including the terminal one), whereas in *S. multicarinata* there are only five.¹ As in the related species the first four thoracic limbs are provided with epipods.

The lateral processes of the exposed thoracic somites are closely similar in the two species, but the anterior process of the seventh somite is more produced in *S. lirata*. In the carination of these somites there are marked differences. In *S. multicarinata* there are clear cut continuous transverse carinae on either side of the fifth somite, whereas in *S. lirata* there are merely irregular tubercles. The longitudinal carinae on the three posterior thoracic somites are similar in the two species, but in *S. lirata* tend to be broken up into tubercles laterally and whereas in *S. multicarinata* practically all the carinae terminate posteriorly in spines, only one pair of spines, those terminating the submedian carinae, are to be found in *S. lirata*.

As in *S. multicarinata* there are numerous carinae on the abdominal somites, but at the sides, especially between the intermediate and lateral carinae they are frequently broken up into tubercles and short ridges which are often not strictly longitudinal in direction. Between the submedian carinae on the first two abdominal somites only three additional keels are to be found in place of the five which are constantly present in *S. multicarinata*.

The formula for the spines on the abdominal somites is as follows:—

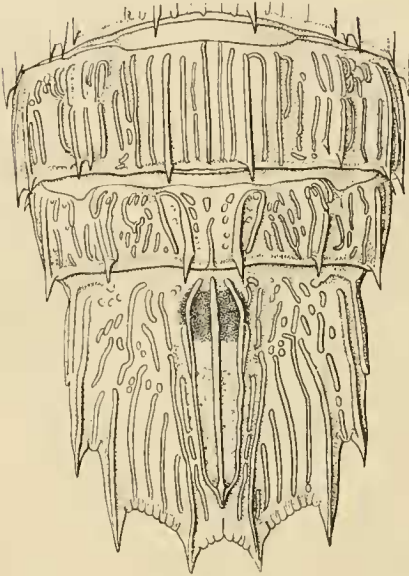
<i>Carinae.</i>		<i>Abdominal somites.</i>
Submedian 1, 2, 3, 4, 5, 6.
Intermediate 1, 2, 3, 4, 5, 6.
Lateral 1, 2, 3, 4, 5, 6.
Marginal 1, 2, 3, 4, 5.

In *S. multicarinata* the lateral carinae of the first two somites and the marginal carinae of the first one, two, or three somites do not end in spines. In *S. multicarinata* all the subsidiary carinae between the intermediates end in spines; in *S. lirata* the only carina in addition to those mentioned in the above formula which ends in a spine is one situated immediately on the inner side of the intermediates of the fourth and fifth somites (text-fig. 4) and even this spine is not always well developed. On the last abdominal somite there are only a few obscure tubercles in place of a continuous carina between the median and submedian carinae,

¹ Miers found seven teeth on one dactylus of a specimen from the Philippine Is. The additional teeth in this individual were perhaps formed subsequent to an injury, for five are uniformly present in the ten specimens we have examined.

and irregular tubercles and ridges between the submedians and laterals.

The carinae on the telson (text-fig 4), both on its upper and under surfaces, are interrupted and few if any extend continuously throughout its length; the differences as regards the upper surface will be apparent on comparing text-fig. 4 with the figure of *S. multicarinata* published in 1913. The inner edge of the bifurcate process of the uropods bears only a series of small denticles in place of the sharp spines found in the allied species.



Text-fig. 4.—*Squilla lirata*, sp. nov.
Last two abdominal somites and telson.

As regards colouration *S. lirata* is distinguished by the presence of a large round black spot at the base of the telson on the upper side. The dusky patch visible on the second abdominal

somite in *S. multicarinata* is also present in *S. lirata*, but of that on the fifth somite no trace can be found. Small dark chromatophores are more thickly scattered over the dorsal surface, particularly on the two ultimate segments of the antennular peduncle. The terminal segment of the outer uropod, which is jet black in *S. multicarinata*, is merely suffused with pigment on its inner side.

The larger of the two specimens is 69 mm. in length.

To summarize the characters which distinguish *S. lirata* from *S. multicarinata* :—

(i) The carinae are less numerous on both carapace and abdomen and tend, especially at the sides, to be broken up into tubercles and short ridges.

(ii) On the exposed thoracic somites only the submedian carinae end in spines; on the abdominal somites, between and including the intermediates, there are never more than six carinae which end in spines.

(iii) The mandibular palp is entirely absent.

(iv) The raptorial dactylus bears six teeth.

(v) There is a large black spot at the base of the upper surface of the telson.

In the number of teeth on the raptorial claw and in the absence of the mandibular palp *S. lirata* resembles *S. costata*. It is, however, readily distinguished from that species (i) by the

more numerous longitudinal carinae on the carapace, exposed thoracic somites and abdomen, (ii) by the spinous termination of the submedian carinae on all the somites from the sixth thoracic to the last abdominal and (iii) by the short carinae on the under surface of the telson.

C 306/1. Singapore. Capt. Hutcheson. 1 ♂, 1 ♀, 60 and 69 mm. TYPES.

The two specimens formed part of a large collection of Stomatopods made by Capt. Hutcheson at Singapore. The collection included also a single specimen of *S. multicarinata*.

Squilla multicarinata, White.

1913. *Squilla multicarinata*, Kemp, *loc. cit.*, p. 86, pl. vi, figs. 73-70.

1918. *Squilla multicarinata*, Sunier, *Contrib. Faune Indes Neerland.* IV, p. 70.

C 305 1. Singapore. Capt. Hutcheson. 1 ♂, 81 mm.

Squilla annandalei, Kemp.

1913. *Squilla annandalei*, Kemp, *loc. cit.*, p. 92, pl. vii, figs. 78-80.

1918. *Squilla annandalei*, Sunier, *Contrib. Faune Indes Neerland.* IV, p. 71.

C 297/1. 4 miles N.N.E. of Kabusa Is., 'Investigator.' 1 ♀, 43 mm. Mergui Archipelago, 33 fms.

The species, which was described from specimens obtained in the Gulf of Martaban, has recently been recorded by Sunier from 30-35 fathoms in the Java Sea.

Genus *Hemisquilla*, Hansen.

1895. *Hemisquilla*, Hansen, *Isop. Cumac. Stomatop. der Plankton-Exped.*, p. 72.

When the memoir on Indo-pacific Stomatopoda was being written the fact that Hansen had proposed *Hemisquilla* as a generic name for the species previously known as *Pseudosquilla stylifera* (M.-Edw.) unfortunately escaped notice. It was, however, pointed out that this species was an outstanding form without any near allies in the genus to which it was referred.

The adoption of Hansen's genus is we think to be recommended, for there can be little doubt that the species for which it was founded has had a phylogenetic origin distinct from all normal *Pseudosquilla*. The recognition of the genus is, moreover, attended with the practical advantage that we are able by admitting it to define the various genera of the family with greater precision.

Odontodactylus cultrifer (White).

1913. *Odontodactylus cultrifer*, Kemp, *loc. cit.*, p. 137.

? 1913. *Odontodactylus carinifer*, Kemp, *loc. cit.*, p. 138.

1918. *Odontodactylus cultrifer*, Sunier, *Contrib. Faune Indes Neerland.* IV, p. 72.

Through the kindness of Mr. J. Moulton, Curator of the Raffles Museum at Singapore, we have been able to examine a

specimens of this scarce species obtained at Pulo Adang, about 100 miles north-west of Penang.

The characters given in 1913 for separating this species from *O. scyllarus* were derived from the published figures and descriptions and were not based on actual comparison of specimens. They may be amended as follows:—

O. scyllarus (Linn.).

Rostrum broadly cordiform; apex pointed and lateral margins strongly convex.

Eyes small, reaching a little beyond base of penultimate segment of antennular peduncle and to base of ultimate segment of antennal peduncle; greatest breadth of cornea about one-fifth length of carapace.¹

Second segment of antennular peduncle about 3 times as long as wide.

Dactylus of raptorial claw strongly inflated at base.

A carina present on last abdominal somite between submedians and intermediates.

Median crest of telson not remarkably elevated, with two submedian carinae on either side; submedian spines of telson broadly expanded, with small movable tips.

Basal segment of outer uropod nearly twice as long as ultimate segment, with 11 or 12 movable spines on outer edge.

O. cultrifer (White).

Rostrum quadrangular with convergent sides; apex broadly rounded and lateral margins slightly concave.

Eyes larger, reaching beyond base of ultimate segment of antennular peduncle and to end of ultimate segment of antennal peduncle; greatest breadth of cornea about one-third length of carapace.

Second segment of antennular peduncle scarcely $1\frac{1}{2}$ times as long as wide.

Dactylus of raptorial claw slightly inflated at base.

No carina on last abdominal somite between submedians and intermediates.

Median crest of telson remarkably elevated, with only a single submedian carina on either side; submedian spines of telson not expanded, with large movable tips.

Basal segment of outer uropod shorter than ultimate segment with 8 or 9 movable spines on outer edge.

The specimen we have examined is a female, 55 mm. in length. The median crest of the telson is apparently less elevated than in the larger individual figured by White. Its height at the distal end is, however, nearly one quarter the basal breadth of the telson, whereas the proportion is less than one eighth in a much larger specimen of *O. scyllarus*.

In the specimens hitherto examined only two teeth have been found on the inner edge of the raptorial dactylus. In our specimens, however, three occur on each side. The knowledge that these teeth vary in number leads us to think that Pocock was perhaps right in suggesting that his *O. carinifer* was based on a young example of *O. cultrifer*. The single specimen that he described under the former name was only 24 mm. in length and all the characters that distinguish it from the related species, except the number of dactylar teeth, may be due to immaturity.

O. cultrifer has hitherto been known from only three specimens: from China (White), from Kelantan in the G. of Siam (Lanchester) and from 27 fms. in the western Java Sea (Sunier). Pocock's specimen of *O. carinifer* was obtained in 24 fms. on the Holothuria Bank, China Seas.

¹ This character probably varies somewhat with age, the eye being proportionately largest in young specimens.

Gonodactylus oerstedii, Hansen.

1895. *Gonodactylus oerstedii*, Hansen, *Isop. C. mac. Stomatop. der Plankton-Exped.* p. 65 (footnote).
 1902. *Gonodactylus oerstedii*, Bigelow, *Bull. U. S. Fish Comm. for 1900*, XX, ii, p. 152, figs. 1, 2.
 1920. *Gonodactylus oerstedii*, Rathbun., *Rapp. l'issch. en Industr. Zee-product. in Curacao, uitg. d. Prof. J. Boeke II*, p. 32 (of reprint).

Through the kindness of Prof. Ch. Gravier we have been able to examine a series of specimens of this species obtained by M. Diguët in the Gulf of California and belonging to the Paris Museum. The sample we have examined, which is only part of a much larger collection of specimens belonging to the same species, is labelled "Espiritu Sancto, Chalut, 15-25 m."

That these specimens from the Pacific Coast should prove to belong to *G. oerstedii* is very remarkable, but except for very young individuals less than 20 mm. in length, all exhibit the additional keel on the inner side of the intermediate teeth of the telson which is the sole discriminating character between *G. oerstedii* and *G. chiragra*. We have made a close comparison between the Californian specimens and others from Fernando Noronha and St. Thomas in the W. Indies and are unable to find any appreciable difference between them.

So far as we are aware the only previous records of a *Gonodactylus* belonging to the *G. chiragra* group from the Pacific Coast of America are those of Miers¹ from Panama and of Nobili² from the Gulf of St. Miguel in Darien. Both authors referred their specimens to *G. chiragra*, but Miers' record was made long before the distinctive characters of *G. oerstedii* were known and Nobili's so soon after the publication of Hansen's paper that it is probable that he had not consulted the work.

Gonodactylus oerstedii has hitherto been found only in the Atlantic and, so far as is known, does not live in the southern parts of that ocean; Miss Rathbun in a recent paper gives its distribution as "North Carolina to Brazil, Bermudas." The occurrence of the species in the Gulf of California is thus most unexpected and points to the conclusion that its distribution is discontinuous. The species of *Gonodactylus* inhabit the warmer waters of the globe and, apart from the absence of any records, it is extremely improbable that *G. oerstedii* extends along both east and west coasts of S. America and round Cape Horn.

Gonodactylus demani, Henderson.

1913. *Gonodactylus demani*, Kemp, *loc. cit.*, pp. 164, 198, pl. ix, figs. 108-111.
 1921. *Gonodactylus demani*, Tattersall, *Journ. Linn. Soc., Zool.*, XXXIV, p. 359.

In 1913 (*loc. cit.*, p. 198) it was pointed out that in specimens of this species from the northern end of the Gulf of Manaar and

¹ Miers, *Ann. Mag. Nat. Hist.* (5), V, p. 119 (1880).

² Nobili, *Boll. Mus. Zool. Torino* XII, No. 280, p. 6 (1897).

in one from the Persian Gulf the inner margin of the inner uropod was devoid of setae, in this resembling Henderson's original figure, whereas in all the other specimens the inner margin was invested with setae.

Tattersall has recently remarked that it is "just possible" that Bigelow's *spinusus* may be constantly differentiated from the typical form by the presence of setae on this margin and, on re-examining all the material at our disposal, we are inclined to agree with him. We find, however, that no precise correlation exists between the degree of spinulation of the telson, the size of its lateral teeth and the presence or absence of the fringe of setae. All that can be said is that in specimens which possess the fringe of setae, the telson has a moderate to large number of spinules, which are usually small, while the lateral teeth of the margin are frequently reduced and sometimes absent. In specimens in which the fringe is absent the spinules are usually larger and few to moderate in number, while the lateral teeth are nearly always well developed.

In the material we have examined the setae on the inner margin of the inner uropod are either present or absent: intermediate forms do not occur. The character thus appears to be more useful for the distinction of a varietal form than the shape of the telson and the extent to which it is covered by spinules, for in both these respects there is a very great range of variation. Bigelow, however, does not refer to the inner uropod in his description of *G. spinusus* and until we are certain that the inner edge bears setae in his type specimens, it is impossible to say whether the new character can legitimately be employed for the separation of a variety under that name.

We consider that a variety, which may at present be termed var. *spinusus*?, should be separated from the typical form on the basis of the character of the inner uropod and, if this be done, a number of the specimens recorded in 1913 as typical *G. demani* must be referred to the variety. Including the additional examples listed below, the distribution of the two forms as represented in the collection, is as follows:—

Typical form,—with inner margin of inner uropod devoid of setae,—Gulf of Suez, Persian Gulf, northern end of Gulf of Manaar, Madras Harbour.

Var. *spinusus*?,—with inner margin of inner uropod provided with setae,—Portuguese E Africa, Persian Gulf, Karachi, Bombay, Gulf of Manaar (Pearl banks).

It will be noticed that both forms occur in the Persian Gulf and Gulf of Manaar and Tattersall has shown that both also occur in the Red sea.

Additional specimens are from the following localities:—

C 337/1.	Tor, Gulf of Suez, Red Sea.	R. B. S. Sewell.	1 ♂, 8 ♀,	21-43 mm.
C 338/1.	Ain Musa, Gulf of Suez, Red Sea.	"	1 ♂,	29 mm.
C 339/1.	Madras Harbour, 4-5 fms.	S. Kemp.	2 ♂, 1 ♀,	18-27 mm.

var. *spinus* ? Bigelow.

C 336/1. Pearl Banks, Persian Gulf. Comm. Willcox. 1 ♀, 22 mm.
5-7 fms.

***Gonodactylus brevisquamatus*, Paulson.**

1913. *Gonodactylus brevisquamatus* and *fimbriatus*, Kemp, *loc. cit.*, pp. 174, 175, pl. x, figs. 115, 116.
1921. *Gonodactylus brevisquamatus*, Tattersall, *Journ. Linn. Soc., Zool.*, LXXXIV, p. 362, pl. xxvii, figs. 5, 6.

Tattersall has shown that *G. fimbriatus* is synonymous with *G. brevisquamatus*.

***Gonodactylus pulchellus*, Miers.**

1913. *Gonodactylus pulchellus*, Kemp, *loc. cit.*, p. 177, pl. x, figs. 117, 118.

C 340/1. Madras Harbour, 4-5 fms. S. Kemp. 3 ♂, 3 ♀, 18-28 mm.

***Gonodactylus nefandus*, Kemp.**

1913. *Gonodactylus nefandus*, Kemp, *loc. cit.*, p. 179, pl. x, figs. 119, 120.

C 351/1. Sorsogon, S. Luzon, Philippines. A. L. Day. 2 ♀, 35, 40 mm.

***Gonodactylus tuberculatus* (Borradaile).**

1907. *Protosquilla tuberculata*, Borradaile, *Trans. Linn. Soc. (2), Zool.*, XII, p. 209, pl. xvii, fig. 1.

This species, which is known only from a single specimen dredged in 39 fathoms at Providence I., N. of Madagascar, was unfortunately omitted from the account of the Indo-pacific forms published in 1913. It appears to belong to the *excavatus* section of the genus and is easily distinguished by the form of the rostrum and telson.

***Gonodactylus glyptocercus*, Wood-Mason.**

1913. *Gonodactylus glyptocercus*, Kemp, *loc. cit.*, p. 186.

C 466/1. Port Blair, Andamans. S. Kemp. 2 ♂, 5 ♀, 19-25 mm.

***Gonodactylus spinosissimus*, Pfeffer.**

1913. *Gonodactylus spinosissimus*, Kemp, *loc. cit.*, p. 191, pl. x, figs. 124, 125.

C 341/1. Port Blair, Andamans. R. P. Mullins. 1 ♀, 24 mm.